

REMARKS

Claims 1-11 were pending in this application. Claims 4 and 11 are cancelled. Claims 1 and 9 are amended. Support for these amendments can be found in the application as filed. Specifically, support can be found in Fig. 2 and on page 10, line 25 – page 11, line 6 and page 16, lines 1-13 of the specification. No new subject matter is believed to have been added by these amendments. Therefore, claims 1-3 and 5-10 remain in this application.

Claims 1, 2 and 4-11 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,223,593 to Kubisiak et al. (hereinafter “the Kubisiak patent”). In view of the above amendments and following remarks, the Applicants respectfully request reconsideration and withdrawal of this rejection.

As set forth in independent claim 1, as amended, the present invention is directed to a flowmeter comprising a resistive heater to be inserted into a fluid; AC power with a frequency ω to periodically heat the resistive heater; a signal processing unit having electrical contact at both ends of the resistive heater for receiving signals generated in the resistive heater and for detecting a 3ω voltage signal generated in relation to a temperature variation of the resistive heater by the AC power among the received signals, and obtaining a phase lag of the 3ω voltage signal relative to the heat generation in the resistive heater; and an operation unit for calculating a flow rate of the fluid based on the obtained phase lag.

As set forth in independent claim 9, as amended, the present invention is also directed to a method of mapping phase lags to flow rates including the steps of: a) providing a resistive heater in fluid moving at a predetermined flow rate, b) supplying AC power with a frequency ω to the resistive heater, c) receiving signals generated in the resistive heater via electrical contact at both ends of the resistive heater and detecting a 3ω voltage signal which is related to a temperature variation of the resistive heater among the received signals; d) obtaining a phase lag of the 3ω voltage signal relative to the heat generation in the resistive heater; e) measuring the flow rate of the fluid; f) repeating the steps b) to e) while varying the flow rate of the fluid; and g) mapping measured flow rates of the fluid to phase lags of the 3ω voltage signal.

The Kubisiak patent is directed to a self-oscillating fluid sensor for detecting selected fluid properties and discloses a variety of embodiments of the self-oscillating fluid sensor. The Examiner relies on the embodiment disclosed at column 10, line 45 – column 12, line 38 and column 16, line 54 – column 18, line 27 of the Kubisiak patent. This embodiment

derives the thermal conductivity of a fluid from the phase or time lag of a single heater element 600. To determine the thermal conductivity, the heater element 600 is exposed to the fluid at substantially zero flow. A processor 626 receives the frequency oscillation of the circuit via interface 624 and computes the time lag associated with the internal phase lag of the heater element 600. From this information, the thermal conductivity of the fluid of interest can be determined. The Kubisiak patent also describes other embodiments that can determine the velocity or flow rate of the fluid.

Independent claims 1 and 9 utilize a voltage signal with a specific frequency (3ω) in calculating the phase lag. The Kubisiak patent, on the other hand, requires that the circuit including inverting amplifier 606, phase shifter 608, amplifier 610, wheat stone bridge 604 and heater energizing amplifier 612 oscillates at a frequency that is related to the internal phase lag of the heater element 600 (see columns 17, line 31-43). Therefore, the phase lag is obtained from the oscillation frequency (see column 17, lines 44-49). There is no teaching or suggestion in the Kubisiak patent on using a specific frequency signal, such as a 3ω voltage signal as required by independent claims 1 and 9, in obtaining the phase lag. Furthermore, if the fluid sensor disclosed in the Kubisiak patent were to utilize such a specific oscillation frequency (a 3ω voltage signal) of the circuit in calculating the phase lag, the obtained phase lag and flow-rate will be constant.

Furthermore, regarding independent claim 9, the Kubisiak patent describes that the heater element is preferably exposed to fluid at substantially zero flow (see column 17, lines 44-46). Claim 9, however, requires, "providing a resistive heater in fluid moving at a predetermined flow rate". Fluid moving at a predetermined flow rate does not correspond to fluid at substantially zero flow as the Examiner contends.

For the foregoing reasons, the Applicants believe that independent claims 1 and 9 are patentable over the Kubisiak patent and the other prior art of record and are in condition for allowance.

Claims 2, 3, 5-8 and 10 depend from independent claims 1 or 9 (or a subsequent dependent claim) and are patentable for at least the reasons discussed herein above in connection with independent claims 1 and 9. Claims 2, 3, 5-8 and 10 are likewise believed to be in condition for allowance.

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CONCLUSION

Based on the foregoing remarks, reconsideration and withdrawal of the rejections and allowance of pending claims 1-3 and 5-10 are respectfully requested.

Respectfully submitted,

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